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INVITED ARTICLE



Predicting real-world behaviour: Cognition-emotion links across adulthood and everyday functioning at work

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ABSTRACT

Inspired by the discovery of positive age trends in emotional well-being across adulthood, lifespan researchers have uncovered fascinating age differences in cognition–emotion interactions in healthy adult samples, for example in emotion processing, memory, reactivity, perception, and regulation. Taking stock of this body of research, I identify four trends and five remaining gaps in our understanding of emotional functioning in adulthood. In particular, I suggest that the field should pay stronger attention to the prediction of real-world behaviour. Using the sample case of work functioning, I outline gaps in current knowledge, including the lack of data on middle-aged adults, the neglect of relevant cognitive-emotional mechanisms, and the unclear role of life experience. Filling these gaps will enable progress in research on emotional aging in and beyond the work setting and enhance its practical utility for individuals, organisations, and society.

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An important discovery in research on emotion–cognition interactions in the past decades has been that the age of research participants matters a great deal. Researchers have uncovered systematic and multidirectional age differences, for instance, in how young and older adults process and memorise emotional material, react to emotional stimuli, infer others' emotional states, and regulate emotions. Findings dovetail with field studies on emotional experience in adulthood, attesting that people tend to enjoy high levels of affective well-being and increasing emotional stability through most of their adult years. Together this body of research has shown: Emotional development does not stop when people enter adulthood but continues in complex and multifaceted ways as adults transition through adulthood and into old age. Moreover, findings demonstrate that emotional functioning represents a domain where age-related gains are possible and frequently observed.

Over the years, the field of cognition–emotion interactions across adulthood has seen a number of trends that added precision to thinking about emotional

development in the adult years. Below I outline what I regard as some of the most important trends. Naturally, several questions were also left unanswered. In particular, I argue that the field has not sufficiently addressed the question whether and when age differences in a given cognitive-emotional process predict real-world behaviour, for example in work settings. Taking the sample case of work functioning, I will illustrate the knowledge gaps we face when trying to study the implications of emotional development for real-world outcomes. An overview of the historic trends and remaining gaps is given in [Table 1](#).

Trends in research on cognition-emotion links across adulthood

In the 1990s lifespan researchers became intrigued by the so-called well-being paradox of aging. In a time when aging was still believed to be associated mainly with decline, multiple studies showed that older adults were surprisingly well-off emotionally (Charles & Carstensen, 2010). Fuelled by the possibility

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Table 1. Research trends and gaps in knowledge on cognition-emotion links across adulthood.

Research trends	Relevant review papers
<ul style="list-style-type: none"> • Testing the generality of positive age trends in well-being 	Sliwinski and Scott (2014); Riediger and Raders (2014)
<ul style="list-style-type: none"> • Testing cognitive-emotional processes and capacities as underlying mechanisms of well-being trajectories 	Scheibe and Carstensen (2010)
<ul style="list-style-type: none"> • Attention to context effects and boundary conditions for relationships between age, cognitive-emotional mechanisms, and well-being outcomes 	Charles (2010); Kunzmann and Isaacowitz (2017)
<ul style="list-style-type: none"> • Testing direct links between cognitive-emotional mechanisms and well-being outcomes 	Isaacowitz and Blanchard-Fields (2012)
Research gaps	
<ul style="list-style-type: none"> • Unclear whether and when emotion-cognition links predict real-world behaviour, such as in the workplace 	Scheibe and Zacher (2013), Diefendorff et al. (2015)
<ul style="list-style-type: none"> • Limited knowledge on middle-aged adults 	Lachman et al. (2015)
<ul style="list-style-type: none"> • Neglect of relevant cognitive-emotional mechanisms, such as interpersonal emotion regulation or emotion understanding 	Doerwald et al. (2016)
<ul style="list-style-type: none"> • Absence of longitudinal data on cognitive-emotional mechanisms 	Doerwald et al. (2016)
<ul style="list-style-type: none"> • Role of life experience is often assumed but rarely ever tested 	Charles and Luong (2013)

to uncover a positive side of aging, the following decades witnessed an explosion of studies aimed at uncovering the cognitive and behavioural mechanisms that could explain why older adults are doing so well emotionally. Through experimental designs and (later on) ecological momentary assessment methods researchers started to investigate age-related differences in the way adults process emotional information and react to emotional stimuli, make sense of emotional events, and use cognitive control strategies to regulate their emotional experience and expression (Scheibe & Carstensen, 2010). As just one example, studies uncovered a cognitive bias in older adults to prioritise positive over negative information in attention and memory, a stark contrast to the well-established negativity dominance in young adults (e.g. Charles, Mather, & Carstensen, 2003). This so-called positivity effect was theoretically foreshadowed by socioemotional selectivity theory which posits a greater focus on emotional well-being when time perspective becomes more limited, as is typical in older age (Carstensen, Isaacowitz, & Charles, 1999). The discovery of the positivity effect inspired so many researchers that just a few years later a meta-analysis identified 100 studies on the subject (Reed, Chan, & Mikels, 2014).

As research findings on the well-being paradox and the underlying mechanisms accumulated, however, it became evident that there were certain inconsistencies in the findings and that not all cognitive and

emotional mechanisms pointed into the same direction. For example, the increasing availability of longitudinal data of emotional experience made it possible to track the same individuals over time. In contrast to many cross-sectional studies, these data suggested that well-being increases come to a halt and even reverse after the 6th decade of life (Sliwinski & Scott, 2014) and certainly in the final years of life (Gerstorf et al., 2010). Additionally, studies showed that well-being advantages in old age do not generalise to all situations or emotions, nor to all older adults. Some areas of emotional functioning considered fundamental to well-being and social integration – such as the ability to accurately perceive others' emotions – were found to be marked by age-related decline (Ruffman, Henry, Livingstone, & Phillips, 2008). The findings on affective reactivity to stressful events and on the successful implementation of emotion regulation strategies also did not show a clear advantage of aging (Doerwald, Scheibe, Zacher, & Van Yperen, 2016; Riediger & Raders, 2014). Whereas certain cognitive emotion regulation strategies (e.g. positive reappraisal) were found to be more successfully utilised at higher age, others (e.g. expressive suppression) are used with stable success. In other words, the well-being paradox was less general than originally assumed.

As the field matured, increased attention was paid to moderators and boundary conditions of age differences in emotional functioning. New theories of well-

being across adulthood emerged that specified contextual boundary conditions of emotional gains with age. Strengths and vulnerability integration (SAVI) theory summarised ideas that older adults – through accumulated life experience – have developed powerful cognitive and behavioural control strategies that help them proactively avoid stressful situations or quickly defuse negative emotions, while at the same time, reduced physiological flexibility threatens older adults' well-being in contexts of high or sustained negative arousal (Charles, 2010). The model of selection, optimisation, and compensation in the domain of emotion regulation, another new theory, suggests that emotion regulation gains with age can be observed only to the extent that older adults adjust their regulatory strategies to their changing cognitive and social resources (Opitz, Gross, & Urry, 2012). It is well-established that fluid cognition declines nearly monotonously with age starting in early adulthood, whereas crystallized cognition – the knowledge gained from experience and training – increases from early to mid-adulthood and subsequently remains stable at least into young-old age (Salthouse, 2012).

The divergent age differences in fluid and crystallized cognition neatly fit findings from laboratory studies of emotional functioning that systematically varied task and contextual parameters. In these studies, age-related stability or gains are often observed when emotional tasks require relatively automatic and effortless processes and when older adults can utilise their crystallized knowledge, as in sharing another person's feelings in a situation familiar to the older adult. In contrast, age-related deficits are more often observed when emotional tasks require high levels of fluid cognition or when older adults cannot utilise their crystallized knowledge, as in accurately perceiving emotional cues in highly artificial stimuli (Kunzmann & Wrosch, 2015). Apart from immediate context factors, these newer theories also suggest that it is necessary to consider individual differences in resources and life circumstances as moderators of age differences in emotional functioning. Charles and Luong (2013) postulated three circumstances that prevent age-related advantages in well-being: social isolation, neurological dysfunction, and chronic stress. Although adults of all ages are negatively affected by these circumstances, decline in physiological flexibility associated with aging should make them costlier for older than young adults. Social isolation, neurological dysfunction, and

chronic stress undermine older adults' strengths in cognitive-behavioural emotion regulation strategies that would otherwise help them avoid or mitigate negative emotions, thereby leading to a state of continual negative arousal. Under high negative arousal, age-related vulnerabilities in physiological flexibility come to the foreground and prolong recovery processes. Consistent with these propositions, studies suggest that high affective arousal is experienced as unpleasant at higher ages (Grühn & Scheibe, 2008) and is more often avoided (Isaacowitz & Ossenfort, 2017).

Another trend in cognition-emotion research across adulthood is the larger effort to establish direct links between cognition-emotional mechanisms and well-being outcomes. Isaacowitz and Blanchard-Fields (2012) pointed out a striking gap in linking cognitive-emotional processes and capacities to well-being outcomes (see also Scheibe & Carstensen, 2010). This is especially apparent in experimental work. Although researchers often *assume* that cognitive-emotional mechanisms are responsible for improved well-being or social relationships with age, researchers rarely demonstrate this empirically. Two recent experiments showcase how such links can be established. Scheibe, Sheppes, and Staudinger (2015) examined age differences in emotion-regulation choice and found that older relative to young adults display an increased preference to use distraction (a cognitive disengagement strategy) over reappraisal (a cognitive engagement strategy) when facing threats to well-being. The relative preference to choose distraction over reappraisal in turn predicted higher state affective well-being in older adults, while no such benefit was found in young adults. Luong and Charles (2014) compared young and older adults' emotional reactions to a controlled negative social interaction and established that older adults' stronger goals to perform well and their more positive appraisal of the confederate mediated positive age differences in affective reactivity and recovery.

Research gaps that become apparent when predicting real-world behaviour: The sample case of work functioning

With these historic trends in mind, what are the remaining gaps in knowledge on cognition-emotion links across adulthood? One aspect that has been relatively neglected, so far, is the question whether age differences in a given cognitive-emotional process

predict real-world behaviour. More generally, it seems that many experimental researchers are concerned with finding out which contextual parameters would enhance or eliminate age differences in cognition–emotion tasks, but rarely ask whether behaviour in the lab has any predictive validity for outcomes outside the lab (see Ackerman, 2017 for a similar argument regarding adult cognition). As a result, we have little direct evidence that, for example, cognitive–emotional processes mediate or moderate age differences in physical and mental health, social relationships, or behaviour in work settings. The time is ripe to bridge the gap between isolating age differences in the laboratory and showing how they matter in real-life. In the following, I will focus on work functioning to illustrate possibilities and complexities that arise when studying the implications of age differences in cognition–emotion links for real-world behaviour.

Although work-related roles are an important part of life during much of adulthood, only recently did the study of work and aging gain prominence. Research on *emotion–cognition links* and aging in work settings is even of more recent origin (Diefendorff, Stanley, & Gabriel, 2015; Scheibe & Zacher, 2013). First studies show that older workers use more adaptive cognitive control strategies to fulfil emotional display demands when dealing with customers (Dahling & Perez, 2010) and to regulate workplace emotions, which benefit their occupational health and well-being (Hertel, Rauschenbach, Thielgen, & Krumm, 2015; Scheibe, Spieler, & Kuba, 2016).

An important open question is whether there is a straightforward link between age, cognitive–emotional processes, and work outcomes. Many studies on emotion–cognition interactions across adulthood consider behavioural outcomes in laboratory tasks under the assumption that such outcomes parallel age differences in real-life functioning. The validity of this assumption seems questionable, however. Focusing on cognitive decline, Salthouse (2012) outlined several reasons why there is a gap between capacities measured in laboratory tasks and real-world performances. First, laboratory environments typically are set up in highly controlled ways and thus measure what people are capable of doing under idealised conditions. Real-world settings, on contrast, are “noisy” and seldom require people to perform at maximum levels. Second, experiments often use novel or artificial stimuli that do not allow participants to use their accumulated knowledge to solve tasks (see also Kunzmann & Isaacowitz, 2017);

whereas in real-world settings older workers can rely on their accumulated job knowledge to fulfil job demands. Third, basic (cognitive or emotional) capacities are not the only predictor of real-world performances. A classic model in organisational psychology assumes that performance results from the interplay of capacities (what people can do), motivation (what people are willing to do), and opportunities (whether people get the opportunity to use their capacities; Blumberg & Pringle, 1982). These considerations suggest that we cannot easily infer that laboratory findings translate into age differences in work behaviours and outcomes. When in experiments younger adults outperform older adults in empathic accuracy or in memorising emotional facts, researchers cannot automatically conclude, for example, that young workers would outperform older workers in recognising emotions or remembering stories of clients on the jobs. Instead, researchers need to explicitly link age differences in cognitive–emotional processes with work outcomes, taking into consideration capacities, motivation, and contextual demands and opportunities.

Another gap is the lack of empirical data on middle-aged adults. For a long time, emotional aging researchers have adopted extreme age-group designs that compare young adults (in their 20s and 30s) with older adults (in their 60s and above). This may be partly due to the hope to enlarge any age differences present, and partly to the difficulty to recruit middle-aged adults for research studies. Only rarely did researchers include a middle-aged group (e.g. Riediger, Voelkle, Ebner, & Lindenberger, 2011) or sample age continuously (e.g. Scheibe, Mata, & Carstensen, 2011). However, middle-aged adults hold key roles in work, community, and private settings and it is important to obtain more knowledge on their cognitive–emotional functioning (Lachman, Teshale, & Agrigoroaei, 2015). When deriving predictions for work functioning the relative neglect of midlife in cognition–emotion studies is problematic as middle-aged adults comprise a large proportion of the workforce and represent the group of ‘older workers’. It is unlikely that age differences are simply linear and can be inferred from extreme age-group comparisons. Midlife is a qualitatively unique period in life. Motivationally, middle-aged adults were found to have a reduced sense of time left (similar to older adults) but a maintained focus on opportunities (similar to young adults, Cate & John, 2007). In terms of capacities, midlife has been described as a period

where deficits and advantages reach an optimal balance, making it possible to observe peak performance on cognition–emotion tasks (Lachman et al., 2015).

Another gap arises from a disproportionate focus on some cognitive-emotional mechanisms at the expense of others. In work settings, three emotional competencies have been found central to job performance: emotion perception, emotion understanding, and emotion regulation, each referring to either own or others' emotions (Joseph & Newman, 2010). A recent systematic literature review on adult age differences revealed very unbalanced attention to these emotional competencies (Doerwald et al., 2016). The bulk of past research of adult development has been devoted to *perceptions of others' emotions* and *regulating of own emotions*, while only very few studies addressed other sub-competencies. In particular the lack of knowledge on age differences in *interpersonal* emotion regulation and *emotion understanding* is unfortunate. Knowledge on the regulation of positive emotions is similarly limited. This compromises our ability to make predictions on how aging would impact interactions of employees with customers, colleagues, or supervisors, which make up a large part of the work day in many occupational sectors and where display rules often prescribe positive emotion expression (Diefendorff et al., 2015). Moreover, it is not only the focal person's age but also the age of the social partner(s) which matter for interpersonal interactions (Fingerman & Charles, 2010), for example in leader-follower interactions (Walter & Scheibe, 2013).

The literature review by Doerwald et al. (2016) pointed at another glaring hole in the knowledge base on emotion–cognition links across adulthood. Of the 195 studies on aging and emotional competencies identified until 2015, only one was longitudinal (Diehl et al., 2014). Although there are now several longitudinal studies of emotional experience (e.g. Carstensen et al., 2011), stress reactivity (Sliwinski, Almeida, Smyth, & Stawski, 2009) and recovery (Leger, Charles, & Almeida, 2018), we lack longitudinal research on most of the emotional processes and capacities thought to underlie well-being trajectories through adulthood. Consequently, it remains open whether any age differences found in cognition–emotion links are indeed a function of aging as opposed to cohort, selection, or attrition effects. In the work setting, there is the possibility of 'healthy worker effects' meaning that only high-functioning

adults 'survive' in the workforce while those with low emotional resilience or poor health will drop out to join the group of the long-term unemployed or early retirees. If organisational studies uncover an age-advantage in emotional processes, therefore, it could simply be due to a select group of the fittest older adults participating in the study. Moving forward there is a strong need to set up longitudinal studies of emotional mechanisms and their links with real-world functioning.

Aside from limitations in research designs, it is notable that theories of emotion–cognition links across adulthood often emphasise the role of experience and expertise in the emotional domain, but that there is very limited theoretical elaboration, or empirical research, on this factor. According to SAVI, life experience leads to greater emotion regulatory strengths with age, but the evidence base is practically nonexistent (Charles & Luong, 2013). The work context provides a unique opportunity to study the role of life experience. Occupations vary systematically in their emotional role demands; thus, occupational histories could serve as a proxy for life experience. For example, occupations in sales and healthcare – also termed emotional labour jobs – require employees to perceive, understand, and regulate their own and customers' emotions to a much larger extent that is the case in manufacturing or office jobs (Glomb, Kammermeyer-Mueller, & Rotundo, 2004). It is plausible that such differences in occupational experience – possibly in interaction with motivational factors and cognitive functioning – predict whether emotional capacities grow or stagnate across the working lifespan and during retirement.

Conclusion

Research on emotion–cognition interactions in adulthood has come a long way. Although the well-being paradox which initially sparked researchers' interests in the topic turned out to be less general than originally assumed, the accumulated knowledge base on emotional aging tells a story of resilience and emotional strengths that come with age. This story is quite different from the story of decline that dominates cognitive and biological aging. A methodological implication is that findings on cognition–emotion links in young study participants cannot simply be generalised to all ages. For example, to the extent that the workforce is aging rapidly, researchers need to check whether common knowledge on the

predictors and consequences of cognitive-emotional mechanisms underlying work functioning are still valid. When trying to apply emotional aging research to the work context, a number of gaps in our knowledge also become apparent. Filling these gaps will enable progress in research on emotional aging in and beyond the work setting. Exploring links between cognitive-emotional processes and real-world outcomes is not only intellectually satisfying but also has important practical implications for individuals, organisations, and societies.

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